BUREAU OF WATER

South Carolina Department of Health and Environmental Control

SHELLFISH MANAGEMENT AREA 13

2006 ANNUAL UPDATE

Shellfish Sanitation Program

Water Monitoring, Assessment and Protection Division
Environmental Quality Control - Bureau of Water
2600 Bull Street
Columbia, South Carolina 29201

July 2006

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

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2006 ANNUAL UPDATE

[Data Thru December 2005]

Shellfish Management Area 13
Shellfish Sanitation Program

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South Carolina Department of Health and Environmental Control

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ANNUAL UPDATE
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SCDHEC EQC Bureau of Water

Data Inclusive Dates:
01/01/03 thru 12/31/05

Classification Change:
__X__ Yes ___ No

Shoreline Survey Completed: YES

Prior Report & Date: Annual -2005

(I)ncreased/(D)ecreased/(N)one:
__D__ Approved
__N__ Cond.
__I__ Restricted
__N__ Prohibited

SUMMARY

Station 27 exceeds the statistical criteria for an Approved classification. Due to the station's central location within this relatively small estury, Frampton Inlet will be reclassified as Restricted in its entirety.

Special study, "*Characterization and Identification of NPS Fecal Coliform Bacteria in Shellfish Growing Areas"* was initiated in January 2002. Primary goals were to determine the sources of fecal coliform contamination, e.g. human, domesticated animals, wild animals, etc. at selected impaired shellfish waters. Methods used included Multiple Antibiotic Resistance (MAR), typing of F+RNA coliphages (viruses that attack *E.coli*), and typing with ribosomal DNA isolated from the E. coli. Portions of Scott, Big Bay, Fishing, Sandy, and Store Creeks and Jeremy and Frampton Inlets were included in the study.

The final report "*Use of Three Microbial Source Tracking Methods to Analyze Shellfish Harvesting waters in South Carolina"* was published in August 2004. The report states that the results of all three microbial source-tracking techniques are consistent with animal–source fecal contamination for the majority of tested sites. Surface water site 13-23 (Jeremy Inlet at Atlantic Ocean) had type I coliphages and a MAR index of zero, suggesting an animal impact. Station 13-22, in the headwaters of Jeremy Inlet, had type I and III coliphages, suggesting a mix of animal and human contamination at the time of sampling.

Rainfall data are a necessary and crucial element used in the management of all shellfish harvest areas. Data available for weather station (382730-Edisto Island 3 SW) for the period January 1, 2004 through December 31, 2005 include numerous periods of missing data. The lack of rainfall data present difficulties in assessing cause and effect relations between rainfall runoff and fecal coliform concentrations.

INTRODUCTION

PURPOSE AND SCOPE

The authority to regulate the harvest, sanitation, processing and handling of shellfish is granted to the South Carolina Department of Health and Environmental Control by Section 44-1-140 of the Code of Laws of South Carolina, 1976, as amended. The Department promulgated Regulation 61-47, which provides the rules used to implement this authority and outlines the requirements applied in regulating shellfish sanitation in the State This regulation specifically addresses classification of shellfish harvesting areas and requires that all areas be examined by sanitary and bacteriological surveys and classified into an appropriate shellfish harvesting classification.

The National Shellfish Sanitation Program (NSSP) Guide For The Control Of Molluscan Shellfish is used by the United States Food and Drug Administration (USFDA) to evaluate state shellfish sanitation programs. The NSSP Model Ordinance requires that a sanitary survey be in place for each growing area prior to its use as a source of shellfish for human consumption and prior to the area's classification as Approved, Conditionally Approved, Restricted, or Conditionally Restricted. Each sanitary survey shall be updated on an annual basis and accurately reflect changes which have occurred within the area. Requirement of the annual reevaluation include, at a minimum, field observations of pollution sources, an analysis of water quality data consisting of the past year's data in combination with appropriate previously collected data, review of reports and effluent samples from pollution sources, and review of performance standards for discharges impacting the growing area. A brief report documenting the findings shall also be provided.

The following criteria consistent with the NSSP Model Ordinance and S. C. Regulation 61-47 are used in establishing shellfish harvesting classifications:

Approved - Growing areas shall be classified Approved when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations which would render shellfish unsafe for human consumption. The Approved area classification shall be designated based upon a sanitary survey, which includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. For waters sampled under adverse pollution conditions, the median fecal coliform Most Probable Number (MPN) or the geometric mean MPN shall not exceed fourteen per one hundred milliliters, and not more than ten percent of the samples shall exceed a fecal coliform MPN of forty-three per one hundred milliliters (per five tube decimal dilution). For waters sampled under a systematic random sampling plan, the geometric mean fecal coliform Most Probable Number (MPN) shall not exceed fourteen per one hundred milliliters, and the estimated ninetieth percentile shall not exceed an MPN of forty three (per five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP Guidelines.

Conditionally Approved - Growing areas may be classified Conditionally Approved when they are subject to temporary conditions of actual or potential pollution. When such events

are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be adopted by the Department prior to classifying an area as Conditionally Approved. Where appropriate, the management plan for each Conditionally Approved area shall include performance standards for sources of controllable pollution, e.g., wastewater treatment and collection systems, evaluation of each source of pollution, and means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate.

Restricted - Growing areas shall be classified Restricted when sanitary survey data show a limited degree of pollution or the presence of deleterious or poisonous substances to a degree which may cause the water quality to fluctuate unpredictably or at such a frequency that a Conditionally Approved classification is not feasible. Shellfish may be harvested from areas classified as Restricted only for the purposes of relaying or depuration and only by special permit issued by the Department and under Department supervision. For Restricted areas to be utilized as a source of shellstock for depuration, or as source water for depuration, the fecal coliform geometric mean MPN of restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

Conditionally Restricted - Growing areas may be classified Conditionally Restricted when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be prepared by the Department prior to classifying an area as Conditionally Restricted. Where appropriate, the management plans for each Conditionally Restricted area shall include performance standards for sources of controllable pollution (e.g., wastewater treatment and collection systems and an evaluation of each source of pollution) and description of the means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish may be harvested from areas classified as Conditionally Restricted only for the purposes of relaying or depuration and only by permit issued by the Department and under Department supervision. For Conditionally Restricted areas to be utilized as a source of shellstock for depuration, the fecal coliform geometric mean MPN of Conditionally Restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an

MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

Prohibited - Growing areas are classified Prohibited if there is no current sanitary survey or if the sanitary survey or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area or indicate that such substances could potentially reach quantities which could render shellfish unfit or unsafe for human consumption.

BACKGROUND INFORMATION

Shellfish Management Area 13 consists of approximately 29,583 acres of shellfish growing area habitat located in Colleton and Charleston counties. It is comprised of portions of the South Edisto River and its tributaries including St. Pierre, Big Bay, Scott, Fishing, Sand, Store, Shingle, and Bailey Creeks. The Pine/Otter/South Fenwick islands southwest of Edisto Beach, including Fish Creek and its tributaries are part of the management area. Two small inlets and their associated creeks, Jeremy Inlet and Frampton Inlet, are also within Area 13.

The area's northern boundary lies slightly north of the Watt's Cut reach of the Atlantic Intracoastal Waterway (AICW). The eastern boundary follows S.C. Highway 174 to the point where it crosses Store Creek and is then defined by an imaginary line that extends southeastward to the northern shore of Frampton's Inlet. The Atlantic Ocean and the mouth of the South Edisto River that separates Edisto Beach and Pine/Otter Islands define the southern boundary. The western boundary is defined by the shoreline of Otter Island, the South Fenwick Islands, and the eastern shore of the Ashepoo River to Fenwick Cut. The boundary continues along the western shore of the South Edisto River, including Alligator Creek, and terminates at Watts Cut. Most of the shellfish resources and harvesting activity is located in the Pine Island/Otter Island area, and in Frampton's Inlet.

The harvesting classifications of Area 13 prior to this survey were as follows:

Prohibited (Administrative closure):

1) All portions of the South Edisto River upstream of Station 20;
2) Big Bay Creek, from its confluence with the South Edisto River at Station 02, to Station 01, Scott Creek at the Mound.

Restricted:

1) Shingle Creek and Milton Creeks from their headwaters to Station 28
2) Sandy Creek, from its headwaters to its confluence with Fishing Creek at Station 05;
3) Scott Creek, from Station 01 at The Mound to Highway 174;
4) Big Bay Creek, from Station 01 to Station 10 in Fishing Creek;
5) Fishing Creek, from its headwaters to Station 04 at Peters Point;
6) Store Creek, from its headwaters to its confluence with St Pierre Creek;
7) St. Pierre Creek, from Station 28 at the confluence of Shingle Creek and Bailey Creek, to Station 03, Mouth of St. Pierre Creek
8) Scott Creek from SC Highway 174 to Station 23 at Jeremy Inlet;
9) Bailey Creek and tributaries, from its confluence with St. Pierre Creek near Station 29, to its confluence with the South Edisto River, at Station 31;

10) South Edisto River, from Station 20 at Alligator Creek to Station 03, Mouth of St. Pierre Creek
11) South Edisto River; a 1000 foot radius extending from Station 02 at the confluence with Big Bay Creek.

Approved: The remaining waters of Area 13.

Station Addition/Deactivation/Modification:

Addition: Station 32 – South Edisto River at Western boundary of 1000 foot Restricted radius around Station 02 (confluence of Big Bay Creek)

The shellfish industry in South Carolina is based on the harvest of the eastern oyster (*Crassostrea virginica*) and hard clams (*Mercenaria mercenaria*). Areas in South Carolina designated for commercial harvest by the South Carolina Department of Natural Resources (SCDNR) include State shellfish grounds, culture permits, and Kings Grant areas.

There are five shellfish culture permits in Area 13. Culture permit 157 is leased to the Flowers Oyster Company; 137, and 138 to Wannamaker/Wilson; and 139 to Baldwin. The general public is allowed to harvest on one State Shellfish Ground in Area 13. Recreational harvesting is allowed for clams and oysters, and commercial harvesting for clams by licensed individuals is currently allowed on the Pine Island State Shellfish Ground (S-140).

Shellfish harvesting season in South Carolina extends from September 16 through May 15, although actual dates may vary. SCDNR has the authority to alter the shellfish harvesting season for management purposes. The South Carolina Department of Health and Environmental Control has the authority to prohibit shellfish harvesting when necessary to ensure that all shellfish harvested in South Carolina waters are safe for human consumption.

POLLUTION SOURCE SURVEY

CHANGES IN POLLUTION SOURCES

Residential and commercial development is taking place on Edisto Island and Edisto Beach. Bailey Island and adjacent Crawford Island, which are bordered by St. Pierre and Bailey Creeks, will be developed into a total of about 45 lots on a total of approximately 944 acres. This will be a low-density development with large lots, and houses on the islands will utilize septic tanks.

SURVEY PROCEDURES

Shoreline surveys of Area 13 were conducted by the Low Country District Shellfish Sanitation staff**,** by watercraft, vehicle, and on foot, during the survey period and are ongoing.

POINT SOURCE POLLUTION

Major sources of actual or potential pollution (see Figure 4):

PERMITTED FACILITIES	PERMIT # / TYPE / DISCHARGE
Edisto Marina	Marina
Edisto Water Sports & Tackle	Marina
Edisto Yacht Club	Marina
Town of Edisto Beach/Golf Club WWTP	ND0063789- Spray Irrigation
Jeremy Cay (Edingsville Beach) WWTP	ND0071510- Spray Irrigation
Hammocks at Jeremy Inlet WWTP	ND0077534 (not shown)-Drip Irrigation
Edisto Shrimp Company- Shrimp farm	SC0040401-001, 002 -End pipes

A. Municipal and Community Waste Treatment Facilities - On Edisto Beach**,** sewer is provided to the Fairfield Ocean Ridge resort and other multiple-unit developments, restaurants, and commercial areas on the beach. Sewer is available to homes along Big Bay Creek.

The Town of Edisto Beach/Edisto Beach Golf Club Inc. wastewater treatment system is located at the end of Holmes Street and serves the Fairfield Ocean Ridge resort community and portions of Edisto Beach. The treatment system consists of aerated lagoons and gas chlorination. The effluent is discharged by spray irrigation to the golf course at Fairfield Ocean Ridge. The facility has recently been upgraded and the permitted discharge increased from 260,000 to 350,000 gallons per day. The permit discharge limits for fecal coliform have been decreased from 200/400 to 14/43 to match the SFH standard of the adjacent water body (Big Bay Creek).

Jeremy Cay at Edingsville Beach has a lagoon and spray field designed to serve up to 42 homes. The Hammocks at Jeremy Inlet has a septic tank and drip irrigation system designed to serve up to 51 homes. The Edistonian General Store's laundromat effluent spray field has been eliminated.

B. Industrial wastes - There are currently no permitted industrial discharges into Area 13.

C. Marinas - S.C. Regulation 61-47, Shellfish defines Marina as "any water area with a structure (docks, basin, floating docks, etc.) which is: 1) used for docking or otherwise mooring vessels; and, 2) constructed to provide temporary or permanent docking space for more than ten boats, or has more than 200 linear feet of docking space." Three marinas and three shrimp boat docks are located on Big Bay Creek. Edisto Marina and Edisto Water Sports have marine sewage pump-out facilities. The Edisto Island Yacht Club does not. There are numerous private boat docks throughout Area 13.

D. Radionuclides - Sources of radionuclides have not been identified within Area 13, and radionuclide monitoring has not been conducted. No other source of poisonous or

deleterious substances has been identified within the area.

NONPOINT SOURCE POLLUTION

A. **Stormwater** - Stormwater runoff impacts water quality by transporting fecal coliform bacteria (and other pollutants) from land to the shellfish growing area.

On Edisto Beach, stormwater from roads and residences is directed toward Big Bay Creek and Scott Creek. Stormwater from the area south of Lybrand Street is directed toward the golf course lagoons that discharge through pipes at three separate locations into Big Bay Creek. A series of lagoons on the northern end of the beach discharge from a pipe at Whaley Street into an area known as the yacht basin, which is a tributary of Scott Creek. A 30" diameter concrete pipe was recently replaced with a PVC pipe.

On Edisto Island, stormwater from roads, residences, and agricultural land is directed to the lowest point of elevation that is typically the nearest creek or marsh. In addition, there are freshwater wetland areas, ditches, and impoundments that drain into tidal creeks. Four 42-inch culverts were recently placed at four locations where roads cross Cowpens Canal. The canal discharges into the headwaters of Fishing Creek. The purpose of the project is to reduce flooding of roadways. During a shoreline survey, two other drainage ditches were found which also discharge into the headwaters of Fishing Creek. Stormwater discharges appear to have contributed to elevated fecal coliform concentrations in Fishing Creek.

Most land disturbing activities in South Carolina must comply with the Stormwater Management and Sediment Reduction Act of 1991. The final regulations, effective on June 26, 1992, establish the procedures and minimum standards for a statewide stormwater management program. For activities in the eight coastal counties, additional water quality requirements are imposed. For all projects, regardless of size, which are located within one-half mile of a receiving water body in the coastal zone, the criteria for permanent water quality ponds having a permanent pool is that they are designed to store the first inch of runoff from the entire site over a 24 -hour period or storage of the first one inch of runoff from the built-upon portion of the property, whichever is greater. Storage may be accomplished through retention, detention, or infiltration systems, as appropriate for the specific site. In addition, for those projects located within 1000 feet of shellfish beds, the first one and one half inches of runoff from the built-upon portion of the property must be retained on site. Since 1992, these regulations have been applied to the development of residential subdivisions, golf courses, and business areas.

B. **Agricultural Waste** - A small herd (approximately 15) of cattle located adjacent to the headwaters area of Sand Creek may be contributing to elevated fecal coliform concentrations at stations 13-05 and former station 13-05A. A commercial shrimp farm is located near the Highway 174 bridge to the island and discharges water from the ponds into Watts Cut.

C. **Individual Sewage Treatment and Disposal (ISTD) Systems** - Many homes on Edisto Beach and the majority of homes on Edisto Island utilize ISTDs for wastewater treatment

and disposal. Interviews with SCDHEC Bureau of Environmental Health indicate that most Edisto Island homes in Area 13 utilize conventional systems, with few modified or ultra-shallow systems in place. The land is relatively high in elevation and drains well. Soils types are Wando, Wagrum, Lakeland, and Charleston. A 50 foot setback from the critical line is required for conventional systems; 150 feet for modified and ultra-shallow.

D. Wildlife and Domestic Animals - There are several impoundments along the South Edisto River upstream of Fenwick Cut that are managed for waterfowl. These may impact shellfish waters downstream as water is typically exchanged through tidal action and also when ponds are drained in early spring to allow vegetation to grow.

This area supports populations of white-tailed deer, raccoons, wading birds, migratory waterfowl, and other wildlife, which may contribute to fecal coliform levels in some areas. Domestic animals present in the area include dogs, cats, horses, and goats.

E. Boat Traffic - The South Edisto River inlet provides ocean access for many recreational and commercial vessels. Additionally, the Atlantic Intracoastal Waterway (AIWW) is located in the South Edisto River between Fenwick Cut and Watts Cut. Commercial and recreational vessels utilize this North/South route.

F. Hydrographic and Habitat Modification - Hydrographic and habitat modification in estuarine areas requires both State and Federal approval. Portions of the AIWW require maintenance dredging. The U.S. Army Corps of Engineers utilizes designated tracts of land adjacent to the AIWW as dredge spoil sites.

A bike path was recently installed on the causeway connecting Edisto Beach to Edisto Island. This earthen causeway crosses the headwaters of Scott Creek. At one time a 40-foot bridge crossed over this tidal creek. In 1939 the causeway was filled in and the road was paved, essentially damming the headwaters. Some local citizens are concerned that this constriction of tidal flow is in part the cause of silting and water quality problems in Scott Creek and have been investigating replacing the causeway with a bridge.

G. Marine Biotoxins - There have been no documented occurrences of toxic algae affecting shellfish water quality in Area 13. The Department participates in a State Task Force on Toxic Algae and maintains a toxic algae emergency response team.

HYDROGRAPHIC AND METEOROLOGICAL CHARACTERISTICS

PHYSIOGRAPHY

Area 13 is part of the St. Helena Sound estuary. The estuary is a drowned river valley/bar built system containing numerous marsh islands and tidal creeks and is among the largest of the South Atlantic estuaries. The average depth of the estuary is approximately 12 feet at mid-tide level. Although a natural channel exists in the lower South Edisto River, extensive shallow areas and numerous tidal flats are evident within the estuary. The AIWW (12 feet at MLW) is the only maintained navigational channel (NOAA, 1994).

Tides - Tides in Area 13 are semidiurnal, consisting of two low and high tides each lunar day. Mean tidal range at the mouth of the South Edisto River is 5.9 feet during normal tides and 6.9 feet during spring tides. The highest tidal ranges of the year occur from September through December. Wind speed/direction may produce considerable variation in predicted tides.

Rainfall - Rainfall data used in this survey is collected at a weather station (382730-Edisto Island 3 SW) located at the Edisto Beach State Park. The rainfall gauge is typically read at about 8:00 AM and the rainfall amount is recorded for that date. As most shellfish samples are collected after 8:00 AM, the rainfall for the sample date + 24 hours has been added to the rainfall summary table. Rainfall for the sample date + 24 hours may correlate better and help to explain elevated fecal coliform concentrations in sample results, particularly if there was zero rainfall on the date of or prior to sampling. The 2004 and 2005 daily rainfall table for weather station (382730-Edisto Island 3 SW) is missing significant amounts of data. The District has found it difficult to obtain accurate real-time rainfall data for Area 13, which is a crucial element used in the management of growing areas. Due to the obvious inconsistency and inaccuracy of data, rainfall information from Station 382730-Edisto Island 3SW will no longer be included in this report.

Annual rainfall is normally about 49.31", with August (7.46") being the wettest month. Approximately 40% of the annual rainfall falls in the three-month period from June to August. Weather patterns during this time period are often characterized by thunderstorms and shower activity of short duration. The months of July, August, and September also have the greatest numbers of days with rainfall exceeding 1.00". The months of December through March historically have the greatest number of days with rainfall exceeding 0.10" and 0.50". Rainfall events during these months are typically of a longer duration.

Winds - The prevailing wind direction between February and September ranges between South and South Southwest (180 to 200 degrees) and between October and January is North Northeast (20 degrees). The annual mean wind speed is 8.5 MPH, with August having the lowest (7.3 MPH) and March the highest (10.0 MPH) mean wind speed.

River discharges - The South Edisto River originates in the midlands of South Carolina and flows approximately 140 miles through the piedmont and coastal plain until it enters the Atlantic Ocean at Edisto Beach. The river discharges at an average rate of 2631 cubic feet per second, based on data collected at a gauging station located at river mile 59.9 (at the Highway 61 bridge in Dorchester County). There is significant impact from freshwater inflow, in the form of low salinities and high fecal coliform concentrations, to stations in the South Edisto River, particularly in the winter and spring.

WATER QUALITY STUDIES

DESCRIPTION OF THE PROGRAM

The Department currently utilizes a systematic random sampling (SRS) strategy within Area 13 in lieu of sampling under adverse pollution conditions. In order to comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period. Sampling dates are computer generated prior to the beginning of each quarterly period thereby insuring random selection with respect to tidal stage and weather. Day of week selection criteria is limited to Mondays, Tuesdays, and Wednesdays due to shipping requirements and laboratory manpower constraints. Sample schedules are rarely altered.

During July, 1998, an updated data analysis procedure was formalized. Samples utilized for classification purposes are limited to those samples collected in accordance with the SRS for a 36-month period beginning January 1 and ending December 31. This allows for a maximum of 36 samples per station yet provides a six-sample cushion (above the NSSP required 30 minimum) for broken samples, lab error, breakdowns, etc. This also allows each annual report to meet the NSSP Triennial Review sampling criteria.

Seven-hundred and ninety-one (791) routine surface water quality samples (<1.0 ft. deep) were collected for bacteriological analyses and classification purposes at 23 active water quality sampling stations in Area 13 during the period 01/01/03 through 12/31/05.

The samples were collected in 120 ml amber glass bottles, immediately placed on ice and transported to the South Carolina Department of Health and Environmental Control's Trident District Environmental Quality Control laboratory at North Charleston, South Carolina or the Low Country District laboratory in Beaufort, South Carolina. An additional 120 ml water sample was included with each shipment as a temperature control. Upon receipt at the laboratory, sample sets that exceeded a 30-hour holding time or contained a temperature control > 10 degrees C. were discarded. Samples collected after September 1, 1986 have been analyzed using the five tube/three dilution modified A-1 method described by Nuefeld (1985).

Surface water temperatures were measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using automatic temperature compensated refractometers. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling. Tidal stages were determined using Nautical Software's *Tides and Currents,* Version 2 (1996).

SPECIAL SAMPLING STUDIES

A special study, "*Characterization and Identification of NPS Fecal Coliform Bacteria in Shellfish Growing Areas"* was initiated in January 2002. Primary goals were to determine the sources of fecal coliform contamination, e.g. human, domesticated animals, wild animals, etc. at selected impaired shellfish waters. Methods used included Multiple Antibiotic Resistance (MAR), typing of F+RNA coliphages (viruses that attack *E.coli*), and typing with ribosomal DNA isolated from the E. coli. Portions of Scott, Big Bay, Fishing, Sandy, and Store Creeks and

Jeremy and Frampton Inlets were included in the study.

The final report "*Use of Three Microbial Source Tracking Methods to Analyze Shellfish Harvesting waters in South Carolina"* was published in August, 2004. The report states that the results of all three microbial source-tracking techniques are consistent with animal–source fecal contamination for the majority of tested sites. Surface water site 13-23 (Jeremy Inlet at Atlantic Ocean) had type I coliphages and a MAR index of zero, suggesting an animal impact. Station 13-22, in the headwaters of Jeremy Inlet, had type I and III coliphages, suggesting a mix of animal and human contamination at the time of sampling.

The study also included a hydrographic dye survey of Fishing and Big Bay Creeks conducted May 1-2, 2002. Tracer dye was released into Fishing Creek, shortly after flood tide, approximately halfway between former station 13-09 (headwaters of Fishing Creek) and 13-10. Results indicate that the majority of the dye stayed in Fishing Creek and that the dye would reach St. Pierre Creek, near Station 13-04, on one (ebb) tide cycle. Dye injected into Big Bay Creek on flood tide, just upstream of the confluence with Scott Creek (near Station 13-01), was found to travel to a point about halfway between stations 13-21 and 13-10. The results of the dye study will be used to determine if specific fecal coliform sources are impacting specific shellfish monitoring stations.

MONITORING RESULTS

Stations 02, 03, 13, 15, 24, 25 and 26 did not exceed a fecal coliform MPN geometric mean value of 14 or a fecal coliform MPN estimated 90th percentile value of 43 and therefore meet statistical criteria for an Approved classification. Stations 01, 04, 05, 07, 08, 10, 20, 21, 22, 23, 27, 28, 29, 30, and 31 exceed a fecal coliform MPN geometric mean value of 14 or a fecal coliform MPN estimated 90th percentile value of 43 mpn, and therefore exceed statistical criteria required for an Approved classification.

Station 32 is a new station with 10 sample results for the review period. A minimum of 30 sample results is required to classify a new station.

CONCLUSIONS

Based on review of fecal coliform bacteriological data and the pollution source survey, Area 13 is impacted by three sources of actual or potential pollution.

NONPOINT SOURCE RUNOFF

Stormwater runoff appears to be the major source of fecal coliform bacteria contamination in the developed portions of Area 13. The impact of rainfall on water quality in tidal creeks in developed areas appears to be greater than in the undeveloped areas such as Pine and Otter Islands. Individual localized rainfall events have more effect than freshwater inflow on water quality at stations in tidal creeks and the two inlet areas in Area 13. Possible sources of fecal coliform bacteria contamination include drainage ditches, freshwater wetlands, failing septic systems, pets, domestic animals (dogs, cats, horses, and cows), wildlife, and boats.

Area 13 tidal creeks are shallow and dilution of fecal coliform contaminated waters with water meeting Approved area criteria does not routinely occur. Additionally, there is very little shellfish resource present in the Restricted areas to facilitate filtering bacteria out of the water.

FRESHWATER INFLOW

Portions of Area 13 receive appreciable freshwater inflow from the South Edisto River, particularly between January and April. The impact is typically confined to those stations (8 and 20) located in the South Edisto River. There is a direct relationship between lower salinity and elevated fecal coliform bacteria concentrations. This was particularly evident during the El Niño event between November 1997 and April 1998 when the area received abnormally high rainfall. Salinity of zero parts per thousand (ppt) was recorded at Station 20. Lower salinity and elevated bacteria concentrations also occur following significant rainfall events (>3.00 inches) and in samples collected at low tide. There are also freshwater wetlands on Edisto Island that drain through ditches into tidal creeks.

INDIVIDUAL SEWAGE TREATMENT AND DISPOSAL SYSTEMS

Soils in most areas of Edisto Island are considered suitable for ISTDs. There are many older homes, however, with grandfathered systems that may not meet current standards. In some areas, erosion of creek banks may have reduced the setback from tile fields and problems related to the density of homes on septic systems may be contributing to elevated fecal coliform bacteria concentrations.

RECOMMENDATIONS

Station 27, *Frampton Inlet Creek Upstream of Boatramp Past First Bend*, exceeds the statistical criteria for an Approved classification. Frampton Inlet, from the Atlantic Ocean to the headwaters at the northern end of Jeremy Cay, is recommended for reclassification as Restricted.

The shoreline survey and bacteriological data review of shellfish Management Area 13 indicates that changes in classification boundary descriptions are necessary. The following classification of Area 13 is recommended (see Figure 3):

Prohibited (Administrative closure):

1) All portions of the South Edisto River upstream of Station 20;
2) Big Bay Creek, from its confluence with the South Edisto River at Station 02, to Station 01, Scott Creek at the Mound.

Restricted:

1) Shingle Creek and Milton Creeks from their headwaters to Station 28
2) Sandy Creek, from its headwaters to its confluence with Fishing Creek at Station 05;
3) Scott Creek, from Station 01 at The Mound to Highway 174;
4) Big Bay Creek, from Station 01 to Station 10 in Fishing Creek;

5) Fishing Creek, from its headwaters to Station 04 at Peters Point;
6) Store Creek, from its headwaters to its confluence with St Pierre Creek;
7) St. Pierre Creek, from Station 28 at the confluence of Shingle Creek and Bailey Creek, to Station 03, Mouth of St. Pierre Creek
8) Scott Creek from SC Highway 174 to Station 23 at Jeremy Inlet;
9) Bailey Creek and tributaries, from its confluence with St. Pierre Creek near Station 29, to its confluence with the South Edisto River, at Station 31;
12) South Edisto River, from Station 20 at Alligator Creek to Station 03, Mouth of St. Pierre Creek
13) South Edisto River; a 1000 foot radius extending from Station 02 at the confluence with Big Bay Creek.

Approved: The remaining waters of Area 13.

Station Addition/Deactivation/Modification: None

Analysis of sampling data for Area 13 demonstrates the probability of a significant impact from rainfall exceeding 4.00" in a 24-hour period. Therefore, a precautionary closure of area 13 will be implemented following rainfall events of greater than 4.00" in a 24-hour period, as measured at the Edisto Island 3-SW Weather Stations. This methodology is associated with the concept of the Probable Maximum Precipitation (PMP). PMP estimates for the coastal United States have been published in a series of hydro-meteorological reports (HMRs) by the National Weather Service (*National Weather Service*). PMP estimates for South Carolina's growing areas are derived from HMRs 51, 52, and 53 (*National Research Council, 1985*).

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TABLE #1
Shellfish Management Area 13
WATER QUALITY SAMPLING STATION DESCRIPTIONS

Station	Description
01	Scott Creek at The Mound
02	Mouth of Big Bay Creek
03	Mouth of St. Pierre Creek
04	St. Pierre Creek at Peters Point.
05	Fishing Creek at Sandy Creek
07	Store creek opposite house with docks on right
08	Edisto River at Ashepoo River
10	Fishing Creek at Pollution Line
13	Mouth of Fish Creek at Otter Island and Atlantic Ocean
15	Headwaters of Pine Island Creek at the fork
20	Northern confluence of Alligator Creek and S. Edisto River
21	Big Bay Creek headwaters at first bend to right past the Neck
22	Headwaters of Scott Creek at Jeremy Inlet at the boat landing
23	Jeremy Inlet at Atlantic Ocean
24	Frampton inlet at north end of Jeremy Cay
25	Frampton Inlet at Atlantic Ocean
26	4,000ft From the Confluence of Fish Creek and Atlantic Ocean at First "T" in Fish Creek
27	Frampton Inlet creek upstream of boat ramp past first bend
28	Confluence of Shingle Creek and Bailey Creek
29	Bailey Creek, first bend adjacent to bluff on Bailey Island (near confluence with St. Pierre Creek)
30	Bailey Creek at confluence with unnamed tributary near Southwestern point of Scanawah Island
31	Bailey Creek at confluence with South Edisto River
32	South Edisto River at Western boundary of 1000 foot Restricted radius around Station 02 (confluence of Big Bay Creek) (**New)**

(Total 23 Active)

Figure 1.
Shellfish Management Area 13 Prior Classification

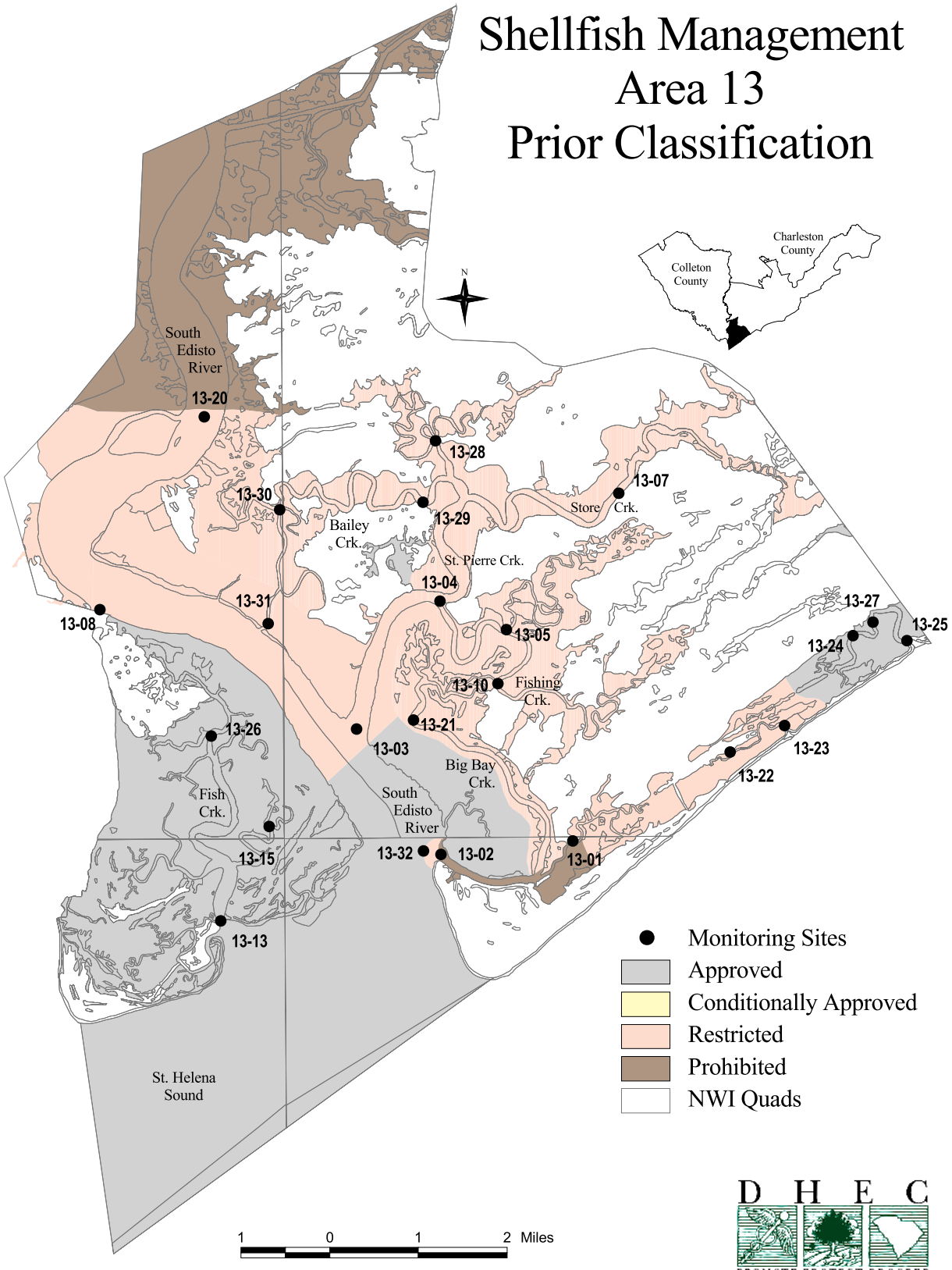

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Figure 2.
Shellfish Management Area 13 Current Classification

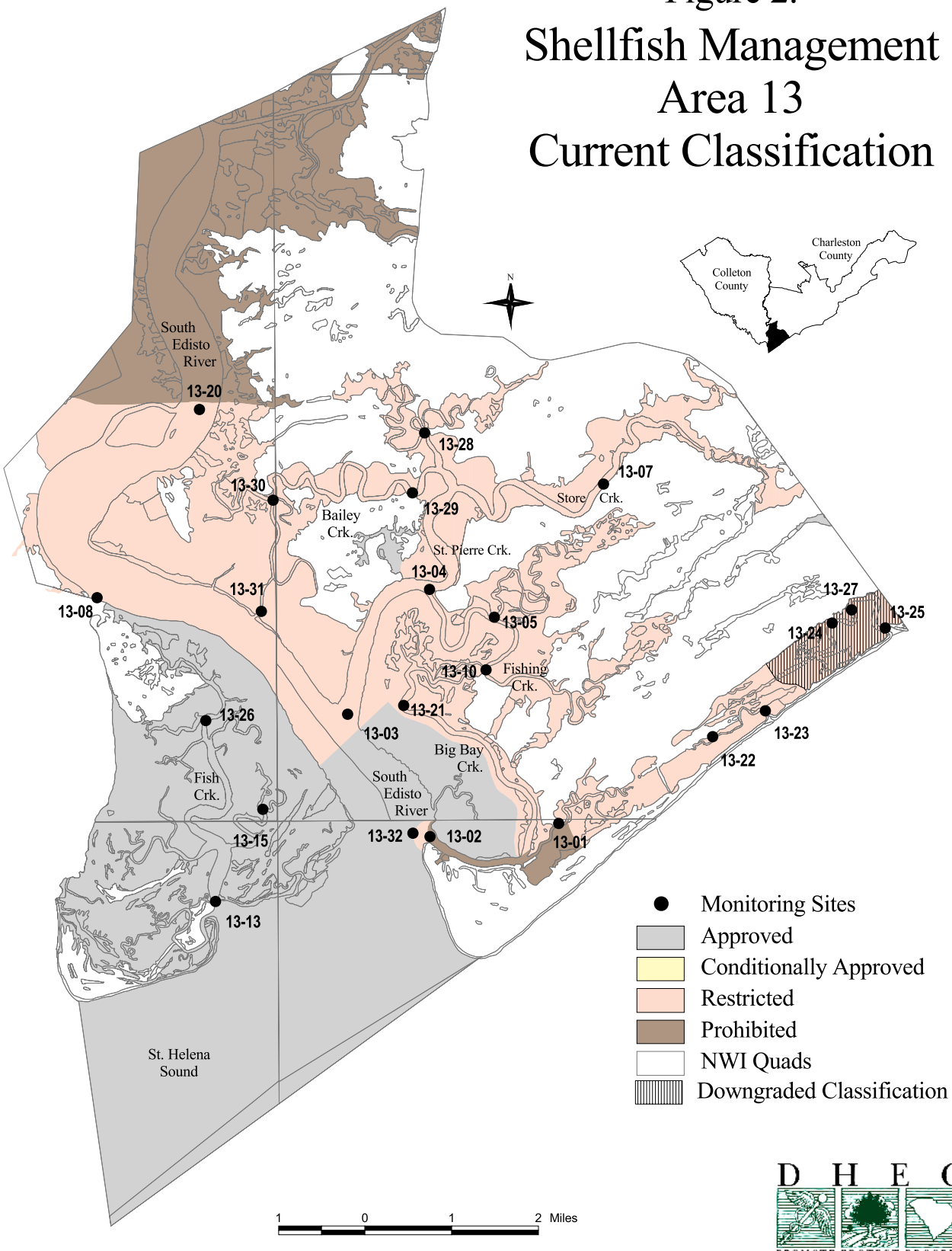

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Figure 3.

Shellfish Management Area 13

Potential Pollution Sources

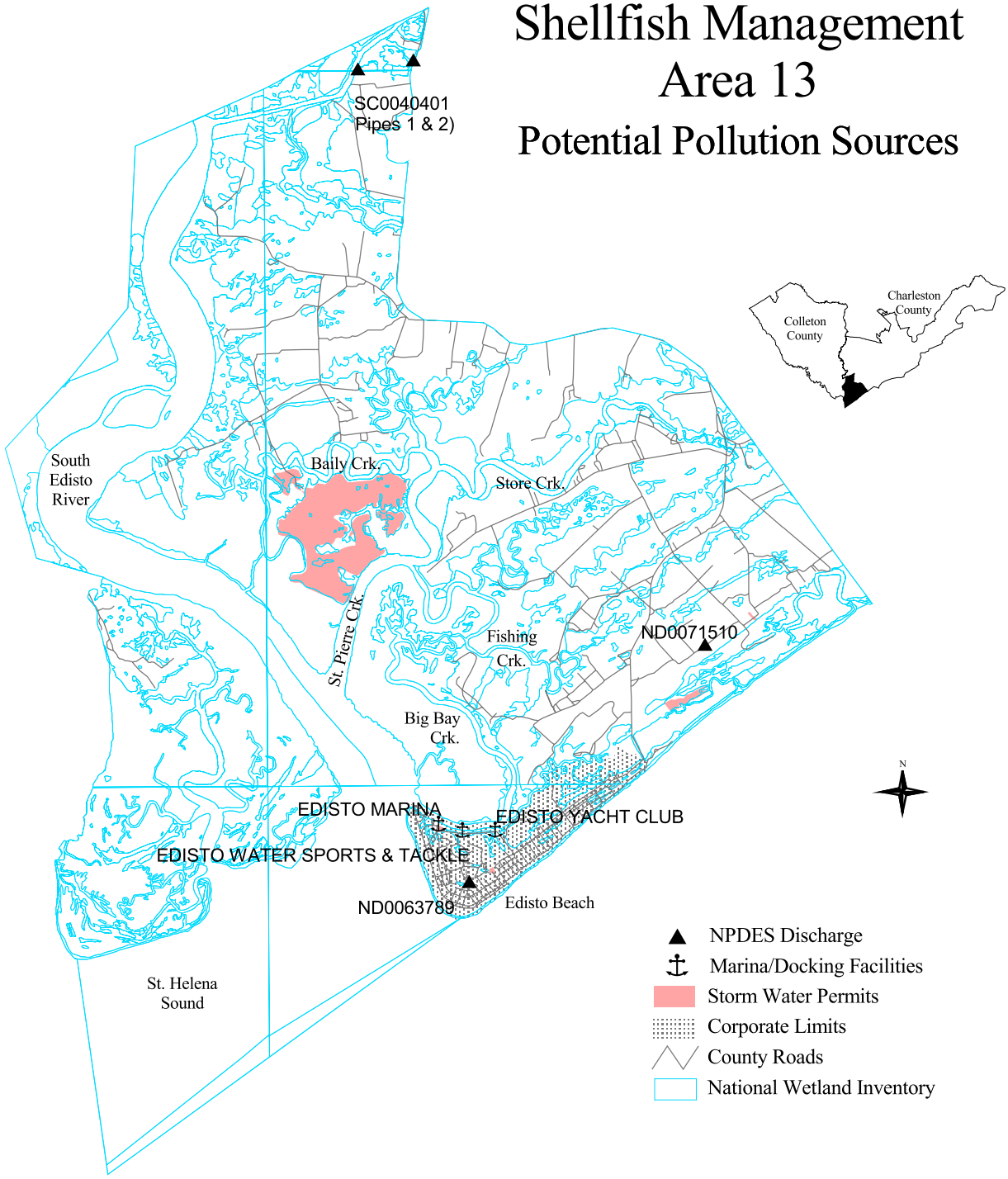

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TABLE #2
Shellfish Management Area 13

FECAL COLIFORM BACTERIOLOGICAL DATA SUMMARY
from Shellfish Water Quality Sampling Stations between

January 1, 2003 & December 31, 2005

Station #▶	1	2	3	4	5	7	8	10	13	15
SAMPLES	36	36	36	36	35	36	35	35	35	34
GEOMEAN	18	6.6	5.8	10.0	25.4	24.8	10.2	28.5	3.4	3.5
90TH %ILE	141	29	22	48	127	124	53	153	8	9
WATER QLTY	R	A	A	R	R	R	R	R	A	A
CLASSIFICATION	P	P	R	R	R	R	R	R	A	A

Station #▶	20	21	22	23	24	25	26	27	28	29
SAMPLES	35	36	36	36	35	35	35	35	36	36
GEOMEAN	13.6	10.9	33.5	12.8	8.4	7.7	5.5	9.7	23.6	20.1
90TH %ILE	93	47	251	100	36	36	21	52	113	83
WATER QLTY	R	R	R	R	A	A	A	R	R	R
CLASSIFICATION	R	R	R	R	R	R	A	R	R	R

Station #▶	30	31	32							
SAMPLES	36	36	10							
GEOMEAN	22.0	9.4	4.5							
90TH %ILE	106	61	13							
WATER QLTY	R	R	New							
CLASSIFICATION	R	R	R							

A - Approved **CA** - Conditionally Approved **R** - Restricted
RND - Restricted/No Depuration **P** – Prohibited

TABLE #3

WATER QUALITY
SAMPLING STATIONS DATA

Shellfish Management Area 13

Detailed data for each shellfish monitoring station listed in this report's "Fecal Coliform Bacteriological Data Summary Table" and in other shellfish reports, can be obtained by writing South Carolina's Department of Health and Environmental Control – Freedom of Information office at the address below.

Freedom of Information
SC Dept. of Health & Envir. Control
2600 Bull Street
Columbia, SC 29201

Any explanation or clarity needed on the report's content can be obtained by contacting the preparer(s), and/or reviewer(s) listed on the cover page.